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RAILROADS IN CITIES.

The recent memorial of the Harlem Railroad Company, to the Corporation of the city of New York, praying for leave to extend a branch of their railroad through certain streets of the city, has attracted the attention of the public, and we feel certain that it will be more fairly discussed than on previous occasions, when similar propositions have been made.

From the earliest construction of railroads in this country, there appears to have been more or less prejudice entertained against their continuation thorough large cities, and consequently, in some cases, at least, important roads were suffered to terminate at points far removed from the centre of business, and not generally accessible without the aid of carriages and omnibusses. The result of these arrangements has, in many cases undoubtedly been a serious injury to the prospects of the work.

Among the reasons given against granting permission to lay rails, or run cars in large cities are the following:—The great danger supposed to arise from using locomotive engines, both on account of the fright they are uniformly said to give to horses, and the risk of running over persons crossing the street. In the next place it was urged, that even if horses were used, too much of the public highway would be taken up by the rails, and that for general purposes, any street so occupied by a railroad, would be entirely useless—to the great injury of the property fronting upon it, or in its neighborhood. A third, and to some persons, insurmountable objection, was the encouragement offered to a monopoly interfering with the free and illimitable rights of citizens.

At the time that these objections were first brought forward, they were considered, by many, as unanswerable, and although great changes have taken place in public feeling, and new light has been thrown upon such subjects, there are doubtless those who, to this day, continue in the disbelief of the propriety of any such arrangements. We had ourselves formerly entertained an opinion unfavorable to any such imagined encroachments

upon the public comfort, safety or rights, but from an attentive examination of the subject, and from the results of the experience of several places in which city railroads have been tried, we cannot but believe that there is a great balance in favor of this mode of transit. Philadelphia and Baltimore, as well as New York, had made the experiment some time since, and now we believe the practice has become quite general. In this city, which, from its great size, furnishes an extreme case, we have had the daily observation of the working of the Harlem railroad, and in speaking on the subject, we shall refer to the operation of the principle in this case.

Let us now consider the objections above named and then proceed to an examination of the advantages which may be adduced on the other side of the question.

The necessity for the use of a locomotive in streets exists in but few cases. It is not contemplated by any one, to introduce engines into the very heart of populous cities, but as it is proper and necessary to use them in the vicinity of towns and in their less crowded parts, we shall stop to consider the difficulties said to be inseparable from their employment. The danger to be apprehended from frightening horses, is greatly exaggerated, and it is a fact worthy of notice, that they very soon become accustomed to the noise and unaccountable motion. This every one must have noticed upon a line of road which has been for some time in operation. We remember watching, with no little curiosity and amusement, the various expedients used upon the Long Island railroad, to disguise the engine in approaching Brooklyn. Among others, a sort of jacket was provided for the bright part of the works, and another for the smoke pipe; and for this or other reasons, various arrangements of the train were made, the locomotive sometimes being behind the cars. After all, it seems to us, that the horses were as little disturbed by the undisguised engine, at the head of the train, as by any other arrangement. In fact, after a while no difficulty whatever occurred, and we have seen spirited horses driven along side of the engine for some time without betraying any symptoms of fear. The noise of the exhaust steam seems to have the most effect to create terror, but we believe that various contrivances for remedying it have been made. The danger of running over passengers is also much less than is generally imagined, except in cases of wilful carelessness, we might almost say, madness. The perfect control under which a steam engine can be kept, at *low velocities*, renders it far superior, as a means of locomotion, to horses in ordinary wheel carriages. A locomotive under the guidance of a steady engine-man, is decidedly safer than a pair of unruly horses, driven by some dandy who is as ignorant of his art, as of managing the steam engine itself—yet who would think of excluding the latter from the highway. Moreover, the risk of accident, small as it is, is confined to a small portion of the street, which the engine never leaves.

As to the objection that railroads are encroachments upon the public streets, we have only to appeal to experience to answer it. It is found that

when the cars are not passing, the street is, to all intents and purposes, as free and unincumbered, as without the rails—while the cars themselves take up no more room than ordinary conveyances, and not so much as a large hay wagon—no one would think of excluding hay wagons from the city, yet they not only travel through the streets, but make regular stands of certain parts of the city, to the undoubted inconvenience of many citizens. Business of all kinds seems to flourish in the neighborhood of city railroads, stores and dwellings are let for higher prices, and property is permanently improved in value, and we feel certain, that no case can be found, in which property near such rail tracks, *used for constant travel*, has diminished in value. The danger to passengers is extremely small, and much less than from ordinary vehicles.

In answer to the third objection, we do not intend to discuss the question of monopoly, convinced, as we are, that a corporation under suitable limitations, is far less of a monopoly than a fire engine company, who, in defiance of law, and at the peril of life and limb—to say nothing of corners of steps, and flag stone—scur not the middle of the street, but the side walks. It must be remembered, that in a large city, every means of public conveyance must be regulated by law, and the number of carts, omnibusses, porters, etc., limited. Now we have at once a monopoly, and one more onerous to the public than a railroad company could possibly be. Nothing can equal the absolute certainty with which all regulations of municipal police, can be enforced upon a railroad, while carriages and omnibusses enjoy a monopoly of lawlessness, and in fact, form the greatest nuisances in our large cities.

But a consideration of the other side of the question will open to us a view of many real advantages and permanent benefits to a city from the use of a well managed railroad. There can be no doubt that the termination of all extensive line of road, in the very centre of a large city, will be a great source of increase of wealth. But no such road should be allowed to lay its rails within the streets of a city, without opening accommodations to that part through which it passes, by running freight cars. All the disadvantages that really attach to such matters, belong as well to the least travelled, as to the most travelled road—while all the benefits belong only to the latter. Some persons entertain strange notions of public convenience, and we have heard those in the councils of our city who were for removing the various steam boat landings as far as possible from each other, in order that strangers might be *compelled* to traverse a larger portion of our city—for whose benefit? why, for that of the hack driver. This sort of reasoning is not unlike that by which we suppose the good people of New York (opposed, as they are, to monopolies,) arrived at the propriety of their present custom, of giving up their residences and taking new ones on the first of May—by which custom, every one is inconvenienced except the cartmen, porters, house cleaners, and last, but not least, landlords, who enjoy the monopoly of having the remainder of the population at their mercy and there-

fore get from them as much as they please and do as little as they can.— Even to these scrupulous people a railroad is no longer a bugbear, for while it facilitates immediate access to the very centre of the city—instead of *straining* the population through the various streets—it likewise facilitates the egress from the centre to the outskirts and fully returns what it had carried in.

In their memorial, the Harlem railroad company mention a circumstance which to us appears worthy of very attentive consideration, viz:—that they are now carrying over one million of persons annually, entirely at their own expense, they keeping the street in order and doing their own repairs. I we only consider, what it would cost to transport one million of persons by omnibusses, (confessedly the most destructive of all vehicles to pavements,) we can imagine the gain of the city. But again, this traffic costs the people less than any other method of conveyance, the fare being at an average of about three-fourths or even one-half that of the omnibusses.

Railroads have justly been called *democratic* institutions, they are for the people, and rich and poor alike derive the advantage from them. In fact, the benefit to the poorer classes is one of our best arguments. How many laborers, living at a distance from their place of work, can, for a trifle, be transported thither, without loss of time or strength. We have no doubt, that calculation would show an incredible amount of labor saved in this manner to the city in each day.

We might go on to multiply arguments in favor of that view which we have taken of the question, but our design has been rather to excite the attention of others than to exhaust the subject.

In conclusion we may remark, that from the orderly and accommodating demeanor of all attached to the Harlem railroad, we feel convinced, that the design of the company, to afford every convenience to the public, will be fully carried out. By the gradual change to eight-wheel cars, a saving will arise to themselves, and increased comfort to travellers, and we have no hesitation in saying, that if the prevailing spirit is carried out in the management of the company, they will be justified by the amount of travel, before long, in resorting entirely to eight-wheel cars.

We wish the company all manner of success and prosperity in their undertaking, and hope that they will realise the reward of their public spiritedness and good management, as they certainly will at no very distant period.

NEW YORK AND HARLEM RAILROAD.

By a memorial, the publication of which was commenced in our last, we learn that an application is to be made by this company, to the corporation of the city for permission to lay a track from the main road in Centre, through Canal street, to the Hudson river; and thereby to accommodate a greater number of citizens than they are now able to do. We were, we must confess, not a little surprised, on reading the memorial, to find that the company, which has labored so long, so perseveringly, and at such an enormous expense to con-

struct a road, by which the *people are* accommodated, and which may with great justice and truth be termed a "Democratic establishment for the convenience of the many"—should still ask to be permitted to increase their outlay to extend their road, for the benefit and convenience of others, under the discouraging circumstances of their case—to wit, 1st, that the stockholders have never yet received any dividend; and, 2nd, the untiring opposition of a portion of this community to the laying of rails through the streets; we were, however, the more gratified to learn their determination to continue "onward" in their course, notwithstanding the difficulties and prejudices to be encountered *and overcome*—as they *certainly will be overcome*—until they shall have extended at least one track to the water's edge.

It is not our intention to enter into a labored argument, at this time, to show the great error, we may say *injustice to themselves*, committed by the citizens in their persevering opposition to the extension of rail tracks into the different sections of the city—as we have *no doubt* of the ultimate success of the system—a system, which will tend as much to the *civilization, harmony* and well being of mankind, even, we had almost said, as the discovery of the art of printing. We will, however, endeavor to show a few of the benefits resulting from the introduction of railroads, and then ask those who oppose them, what may we not *eventually* anticipate from them, if, in 10 years, so much has been accomplished, even in their unfinished and *unconnected* condition; and, in the face of such opposition to, and prejudices against their entering large cities, and thereby forming a connection with other roads.

It is not surprising that a portion of our citizens, who see only one side of the picture, should oppose them; but it is singular to us, or would be, if we did not understand the difficulty of divesting ourselves of pre-conceived opinions—often formed without sufficient knowledge of the facts—to see those whose business must have been benefitted by the extension of a line of tracks, petitioning for the removal of the very means which brought customers to their door; the removal of which will most certainly turn them in another direction. It, however, only adds one more to the numerous instances in which we see people mistake their own interests, and which they only appreciate when too late to be benefitted by the knowledge.

It may, perhaps, in the present mode of laying the rails, be objected to them, that they incommode other vehicles in crossing the tracks; and also that they now interfere with the stages, and will eventually interfere with the cartmen—and, therefore, should not be extended to the rivers, nor be permitted to connect with other roads. So might it have been objected to the introduction and use of carts, that they interfere with the *porters* and *hand cartmen*; and to the stages, that they took passengers from the hackney coaches. These latter, however are objections not sustainable, as the streets are not designed *alone* for carts, stages, and coaches; nor have cartmen any *exclusive* right to the carrying trade in cities; nor stages and hackney coaches to the carrying of passengers; but the greatest good, and

convenience of the greatest number of people, and amount of business should in this, as in other matters, be consulted as far as may be, by giving people a choice in the mode of doing their own business in their own way; and especially for the convenience of travellers, who ought not to be compelled to employ an extra conveyance, and be subjected to the extortion and abuse of hackmen, as is too often the case in large cities, to get from one railroad and steamboat to another—and as to the former, *the mode of laying the tracks* that will beyond all question be improved so as to permit carriages to cross them without difficulty.

It is also true, at least so far as we have been able to ascertain, that railroads for transportation and travel have in all cases added to, instead of detracting from the business of carts and coaches—by increasing to an astonishing amount, as will be seen, the business of cities; and it appears to us that instead of being a disadvantage, their extension will be a great and direct advantage, by increasing the quantity, and at the same time, reducing the average distances to which the loads are to be carried on carts, thus enabling the same force to accomplish more useful effect.

We will not, however, attempt here to argue the question, but give the remainder of the memorial to which we allude, together with some interesting railroad statistics which were selected for the last number but excluded by other articles.

MEMORIAL OF THE NEW YORK AND HARLEM RAILROAD COMPANY.

(Continued from page 16.)

Your memorialists, therefore, most respectfully pray your honorable body to grant this company permission to continue their rails from Centre street, through Canal street to the North River.

Your memorialists would here remark, that if this privilege be granted to the Harlem Railroad Company, they are convinced it would greatly benefit every portion of the island, and particularly a large mass of daily laborers; nor should it be forgotten, that the advantages it confers will be common to all classes of our citizens, of every lot and condition in life. Further, to use the language of Chevalier de Gerstner, a distinguished engineer of Austria, who speaking of the Belgian railroads called them “a popular, democratic establishment, receiving the approbation of the people and every intelligent man.”

It is indispensable that residents far from the centre of business, should be able, in a cheap and expeditious manner, to reach their places of trade.—The lower part of the city is constantly changing from dwelling houses to stores; and as this change takes place, the inhabitants, together with the increase of our population, are compelled to remove either to the upper part of the city, or to the adjoining towns and villages.

The island is narrow, and your honorable body accommodate with ferries, almost an unlimited extent, those who reside in places beyond your jurisdiction, and who often, to the inconvenience of the commerce of the city, have great facilities for coming into and leaving it, and who are exempted from personal taxes, and many other burthens; while sound policy would seem to indicate that the most approved modes of conveyance should be adopted for traversing our city, from one extreme point to the other, presenting for public use, attractions equal, at least, to those offered by our neighbors of Boston, Philadelphia, Baltimore, Brooklyn and Jersey city, and thus, by affording inducements to the inhabitants of neighboring states to

remove within our precincts, augmenting our population and wealth, and contributing to the expense of the city government.

But, in addition to all this, it should be borne in mind, there are other, and, perhaps, stronger reasons in favor of the extension of our rails, to the North and East rivers, where ample accommodation may be afforded for all commodities intended for exportation.

Your memorialists believe that this road is but the first link in the main chain of that mighty and measureless system of internal communication, which, connecting with the New York and Albany Railroad, commencing by its charter, at the termination of our own work, and branching throughout our State, throughout New England, and to the whole interior of the Great West, will be rendering those immense inland communities tributary to this State and its metropolis!

This, then, opens other and wider prospects of incalculable value.—Where must all the passengers borne on all these gigantic avenues of internal communication be finally concentrated? Will not the surplus productions of this vast interior, be poured into this, its great commercial emporium?

And will not this, our city railroad, become the first section of that great central avenue through which these rich streams of agricultural and manufacturing productions are destined to flow, not only for the use and benefit of our own citizens, but millions for export to other States and other nations? Surely, then, your honorable body cannot but feel the importance of allowing our railroad free access, at the most eligible points, to that ocean, where these innumerable commodities of our country may be borne to every clime.

If this view of the future usefulness of our work be correct, and your memorialists cannot doubt it, our road does not merit the resentments, jealousies, and sectional prejudices sought to be excited against it. On the contrary, the work, completed by individual enterprise, unaided by the funds of the state or the nation, forming the first link in the stupenduous chain of our magnificent system of internal improvements, and, perhaps, the most difficult and expensive of the whole series, deserves the countenance and support of every liberal and enlightened mind.

In conclusion, your memorialists believe, that a simple reference to the unexampled extension and matchless prosperity of our city as the triumphant result of a free water communication with all parts of the world, furnishes an irresistible argument in behalf of an equally free railroad communication, as scarcely less essential to individual and general prosperity.

By order.

SAMUEL R. BROOKS,

President of the New York and Harlem Railroad Company.

New York, December 2nd, 1839.

DUBLIN AND KINGSTON RAILWAY.

The Dublin and Kingston railway is a passenger railway only, yet it is proposed to bring it into the city, even to and above the river, and to do so, it is proposed to remove nearly 40 houses.

This is, at present, wholly a passenger railway, about 6 miles in length. The public road traffic, previous to the construction of the line, was carried on principally by cars, besides which, there were many private carriages, saddle horses, and other conveyances. To ascertain the amount of previous traffic, persons were employed to note the number which passed between six o'clock in the morning, and nine o'clock at night, for 37 weeks,

i. e., from the 14th of February to 30th October, and the result was, 29,256 private carriages, 5,999 hackney coaches, 113,945 private jaunting cars, 149,754 public jaunting cars, 20,070 gigs, 40,485 saddle horses, and 58,297 carts.

From the amount of general traffic, thus ascertained, the estimate of probable railway traffic was made up on public cars only, viz:—

37 weeks,		149,754 cars
15 weeks at same rate,	60,711	} 45,533
Deduct 25 per cent. for difference of season, 15,178		

Number of cars,	195,287
Allowing four persons to each,	4

Annual number,	781,148
Estimated increase,	390,574

Total	1,171,722
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Which, at 6*d.* each, amounts to an annual revenue of 29,293*l.*

The actual numbers conveyed since the opening, December, 17th, 1834, have been,

	Passengers.	£	s.	d.
From December 17th, 1834, to March 1st, 1835,	136,829	4,177	9	8
From March 1st, 1835, to March 1st, 1836,	1,097,971	31,130	6	8
From March 1st, 1836, to March 1st, 1837,	1,184,428	31,901	5	10
The general daily average number of passengers being about 3000.				

BRUSSELS AND ANTWERP RAILWAY.

The Brussels and Antwerp railway also is used mostly for passengers, and has established the truth of the remark that the establishment of railways is for the convenience of the *people*, by increasing the number of passengers the first year, from 80 to 563,000, and the 2nd year to 872,000.

This is a union of two lines from Brussels to Mechlin, distance about 13½ English miles, and from Mechlin to Antwerp, about 14½ English miles.

The total number of passengers carried on the road between the two extremes, was about 80,000 annually, conveyed in from 15 to 20 diligences, besides canal passengers, the number of which is not stated.

The line from Brussels to Mechlin was first opened 7th May, 1835; and the number of passengers conveyed by it to the end of April, 1836, was 563,607; and from the first of January, 1836, to 31st December, 1836, the number conveyed amounted to 872,893.

The other part of the line, from Mechlin to Antwerp, opened May 1st, 1836, and from that time to August 15th, the number of passengers (long and short stages) was 369,452; and from August 1st, to October 31st, 256,673, making a total of 626,125 passengers, of which 187,233 traversed the whole distance. The remaining part went only to intermediate stations.

Similar results are witnessed here, and yet we find a *few of the people* opposing the extension of the tracks in this city, because they say it is a "monopoly!"—true it may be termed a monopoly, not, however, for the benefit of the stockholders, who have not in seven years received a penny of dividend, but the *monopoly* is to the poor man, the business man, the infirm, and the indolent, who can ride 2 miles for 6*d.* every five minutes, from 7 A. M. to 8 P. M.

In other cities, railroads are extended through different streets to the water; there are turnouts for the purpose of permitting the cars to pass directly into the store houses to load and unload, so that the greatest beneficial effects may result from the least labor. Thus it *should* be, and thus it *will eventually* be here, when the real advantages of this mode of communication are better understood, and duly appreciated. The greater the opposition of the few, the more certainly will the people—the multitude whose convenience they are—require their extension, not only through *Canal*, but through other streets also to the rivers.

INTERNAL IMPROVEMENTS OF NEW YORK.

In the enlargement of the Erie canal, two leading objects were proposed to be obtained.

1st. To accommodate the supposed great increase in trade,

2nd. To cheapen transportation.

The Erie canal was originally constructed forty feet wide upon the surface and four feet deep. The locks fifteen feet in width, and ninety feet in length, inside measurement, with an average lift, a little less than eight feet, and capable of being navigated by boats carrying 50 to 60 tons. According to the plan for the enlargement, the dimensions of the canal are to be increased to seventy feet in width, at the surface, and seven feet in depth, with locks, seventeen feet in width and one hundred and ten feet in length in the chamber—the lifts of the locks remaining nearly the same as originally established, viz:—a little less on the average than eight feet, and capable of being navigated by boats carrying from 100 to 150 tons.

The original cost of the canal did not vary much from \$8,000,000

Since its completion (in 1835,) about \$400,000 has been expended annually in repairs and superintendence, nearly one-third of which has been appropriated towards making the canal better than it originally was; that is, in the erection of new bridges—the raising and rebuilding old ones in a more permanent manner—the widening and rebuilding aqueducts, and wastweirs—the construction of inside slope or protection walls—the widening and deepening the channel, &c.—amounting in all probably to \$2,000,000

Total cost of the Erie canal, at the time of commencing the enlargement, \$10,000,000

It is now proposed to expend in making the enlargement throughout the whole extent, viz: 363 miles, according to the estimate rendered last winter to the Legislature, nearly \$25,000,000

The first estimate for the enlargement, was \$12,500,000 nearly. In making this estimate the great difficulties of the undertaking were not fully comprehended. The second was in like manner defective, though approaching nearer the

truth. Unless the plan shall be materially changed, the cost will, in all probability, exceed the last estimate, by \$5,000,000

Making a total of \$30,000,000

It is obvious, that the benefit of this improvement cannot be fully realised until the canal is enlarged throughout its whole extent. At the rate at which the work has thus far progressed it will occupy full ten years. There should, therefore, be added to the above sum the interest on money expended from year to year, until it is completed, which cannot well be estimated at less than \$10,000,000

Total cost of the enlargement, \$40,000,000

To which add the original cost of the canal, which is merged in the enlargement as above stated, \$10,000,000

Gives a total of \$50,000,000

which the Erie canal will cost the State when the enlargement is completed on the plan contemplated.

By the aid of the steamboat tax, the auction tax and the salt tax, the original cost of the Erie canal has been provided for. Without this extraneous aid, the canal, with its boasted business and revenue, would barely have paid the interest on its cost, repairs and superintendence, and the State would now have been in debt for an amount equal to its cost. This assertion will doubtless surprise many, but it is nevertheless true, that if the Erie canal had depended upon its own revenue for the liquidation of its debt and payment of the expenditures necessary to keep it in operation, it would now have been in debt to an amount equal to its original cost. For the proof of this, see the report of the comptroller, January, 1839.

It is now the intention to add to the cost of the Erie canal nearly \$40,000,000, in effecting an enlargement of its channel, which expenditure we shall demonstrate is not required by any reasonable anticipations of the increase in trade, which will necessarily pass upon it; and not warranted by any other advantages which are likely to accrue from it.

From the completion of the Erie canal to the period when the enlargement of its channel was contemplated, viz:—in 1835, the increase in the amount of transportation had been rapid, exceeding very greatly all previous calculations. Upon the eastern portion of the canal where the press of business was the greatest, the number of lockages were very nearly equal to the capacity of the locks, and hence the apparent necessity of some further provision for the anticipated increase in the business either by doubling the locks, or by an enlargement both of the locks and the channel of the canal.

This anticipated increase in the trade has not since been realised. By the comptrollers report, above referred to, it appears that the number of tons

of freight coming to tide water on the Erie canal for the four past years is as follows:—

1835	753,191 tons.
1836	696,337 "
1837	611,781 "
1838	640,481 "

From which it appears, that the tonnage for 1838 is about one-sixth less than for 1835.

The preponderance of the trade on the canal is in the direction of tide water, in the ratio according to the report just referred to, of $4\frac{1}{2}$ tons descending, to one ton ascending. There is consequently no necessity for an enlargement of its channel to accommodate the *ascending* trade or that going west.

The descending trade is composed mainly of the productions of the "forest" and "agriculture."

The number of tons of the former coming to tide water in 1835 was 540,202, in 1838 it was 400,877, showing a decrease of 139,325 tons—the number of tons of the latter in 1835 was 170,954, in 1838 it was 182,142 showing an increase of only 11,188 tons. That is, the *increase* in the agricultural products for the four years mentioned was only *one fourteenth* part of the *decrease* in the products of the forest for the same time. In this proportion it will require, *at least, fifty* years for the increase in the agricultural products to equal the falling off in the products of the forest in *four* years! Should therefore the latter continue to decline in the same or even a less ratio than heretofore the canal, instead of being *more*, will for some years to come, be *less* crowded than it has hitherto been.

That there will be a considerable falling off in the product of the forest, there is little doubt. The whole number of tons of every description of freight coming to tide water in 1838, was 640,481, of which 400,877 tons or nearly two thirds was from the forest and composed almost wholly of timber, boards, scantling and ashes. These, therefore, so far as tonnage is concerned, are now the prominent items of transportation upon the canal.

All of the more valuable timber within reach of the canal is nearly removed, and will not be replaced any considerable portion of it, by a second growth. This is strictly true of the pines, hemlock, spruce and tamarack, which constitutes the bulk of the timber conveyed to market.

In addition to this, lumber of various descriptions has already attained a price in market, owing to its scarcity, which brings it in competition with the timber from the Carolinas, Georgia, Maine, and New Brunswick. From the first named States is now obtained a large portion of the more valuable timber used in house and ship building in the City of New York. Much of the timber used in the construction of railways in the northern States is also obtained from the same source. The portions of the State of New York in which any considerable amount of timber is to be found are the northern and south-western. That from the former finds a

very direct route to market through the Champlain canal. That from the latter, in consequence of the cheap descending navigation of the Alleghany and Ohio rivers passes off in that direction—and what will surprise many who are not conversant with the course of business in that section of the country, is used to a very considerable extent in the construction of buildings in Indiana and Illinois.

Those who are acquainted with the business upon the Erie canal know that there is a very great difference in the tonnage or transportation on its eastern and western divisions. From Albany to Buffalo, the tonnage may be said to decrease almost in an arithmetical ratio. The extreme western portion of the canal is in fact in a similar condition as it regards business with the lateral canals, compared to them, it is like the spindle-top of a tree compared to its branches. Much has been said of the unproductiveness of the lateral canals, but the fact seems to have been overlooked that the western portion of the Erie canal is open to the same objection. The Oswego branch, terminating at Lake Ontario, is 38 miles in length. The estimates of cost and reports of the Comptroller show that the nett receipts from this branch from the business passing upon it, are greater, compared with its cost, than the corresponding receipts, from an equal extent of the extreme western portion of the Erie canal terminating at lake Erie. By this statement we do not mean to be understood to say that the business is the greatest on the Oswego canal, but that relatively to its cost, the nett receipts are the greatest and hence the most profitable. That the business upon the Erie canal is much the greatest on its eastern than upon its western sections is evident from the fact already adduced, that two thirds of the tonnage descending to tide water, is the product of the forest, nearly all of which, by reference to the Comptroller's report, is brought to the canal east of the Seneca river. The points where most of the lumber is received are at the junctions with the Cayuga and Seneca and Oswego canals and with the Oneida Lake canal near Rome.

West of Montezuma or Syracuse the Erie canal is far, *very far* indeed from needing enlargement to accommodate any anticipated increase in the trade upon it. This part of the Erie canal embraces an extent of about *one hundred and ninety miles*, or more than one half of the whole extent of the canal.

The estimated cost of the enlargement of this portion, not having the report at hand to refer to, cannot be stated with precision, but it can not, it is imagined, vary much from about three-eighths of the whole cost, or according to what is shown above, about *fifteen millions* of dollars. The expenditure of this sum will not, as in the case of the construction of a new work enhance the value of real estate, and other property in its vicinity. It is in fact, a work most completely of supererogation, not needed for the purpose designed, and will, if persisted in, serve only as a monument of the folly of its projectors and advocates, and prove a cause of deep and lasting regret.

Other reasons may be adduced why the enlargement of the Erie canal

is not required, to accommodate the prospective business upon it. These with our remarks upon the effect of the enlargement, in reducing the cost of transportation, will be reserved for another communication.

FULTON.

The following *legal* opinion, as to the right of the Common Council to permit the laying of rails in the streets, will be found both interesting and useful.

CASE FOR COUNSEL.

The Board of Aldermen of the city of New York, at their meeting on the 30th December, 1839 passed the following resolution :

By Alderman Purdy—Resolved—That the Counsel of the Corporation report to this Board, his opinion upon the right of the Common Council to permit the Harlem Railroad Company, or any other chartered company, to use the centre of the public streets for private purposes and individual gain, so as in any respect to abridge the use of the public therein.

The resolution passed by the Board of Aldermen upon which I am desired by the Harlem Railroad Co. to give my opinion, purports to inquire whether the Common Council have a right "to permit the Harlem Railroad Company, or any other chartered Company, to use the centre of the public streets for private purposes and individual gain, so as in any respect to abridge the use of the public therein."

If I should confine myself to answering this inquiry in the shape in which it is put, I should probably say that the Common Council have no such right. But it is obvious that the language of the resolution does not reach its own purpose and such an answer would therefore be illusory in respect to the inquiry really meant.

This resolution by coupling the Harlem Railroad Company with "any other chartered company," assumes that in respect to using the centre of the public streets, the privileges of all *chartered companies* might be alike, which neither follows as a matter of course nor is legally true; and by designating that use to be for *private purposes* and for individual gain, it begs the very question upon which the determination of the matter rests.

I presume the object of the resolution was to test the right of the Common Council to permit the Harlem Railroad Company or any other chartered Railroad Company, to lay rails and run cars over the centre of any public street; and in this view of the subject I have no hesitation in saying not only that the Common Council have such right, but that if (all things considered) they should deem that public convenience would be promoted by such permission it is their duty to grant it.

The character of a chartered railroad company in respect to the *public* or *private* nature of its purposes admits no longer of a question. Those companies belong to that class of corporations, such as turnpikes, ferries, canals and bridges, when the *uses* are all public, although individuals may be benefitted. The general principle that all such enterprises are for *public use and accommodation*, although undertaken and conducted by pri-

vate corporations, or even by individuals, has been repeatedly decided both in the State Courts, and the Supreme Court of the United States; and in this State that principle has been extended to chartered railroad companies by the Court of Chancery in the case of *Beekman vs. Saratoga Railroad Co.*, 3d Paige, Rep. 45, and by the Supreme Court in the case of *Bloodgood vs. Mohawk and Hudson railroad Co.*, 14th Wendell, Rep. 51. In those cases the right of railroad companies to take private property on making just compensation against the will of the owner, was fully and ably discussed; and that right was established on the ground that such companies are incorporated for public convenience. The question of private or individual gain (or possibly loss) has nothing to do with the subject. It is merged in the consideration of public benefit.

I therefore take the following grounds:—

1st. Railroads are made and conducted by chartered railroad companies for the purpose of affording better accommodation to the public for travelling and transporting property from place to place, than they could otherwise enjoy.

2d. The very end for which streets are laid out, is that the public may have the greatest facility for such travel and transportation of property, by such modes of conveyance as may best answer the purpose.

3d. The power of regulating the use of the public streets of this city rests with the Common Council, and they are bound so to exercise that power as that the public may derive the greatest amount of benefit from such use.

From which I draw this conclusion; that if the public will derive a greater amount of benefit or convenience from having a railroad in operation through any street, than they could enjoy without it, the Common Council have clearly a right to allow a chartered railroad company to make and conduct one through such street. It is within the compass of their duties so to do.

The resolution supposes that such use of a street by the railroad company may in some respect abridge the use of the public therein.

This is a point upon which any one may from observation or experience form his own opinion; but be it as it may, it cannot effect the question of the *right* of the Common Council although it might influence their discretion in the exercise of such right.

The power of regulating, necessarily carries with it the power of abridging an indiscriminate use of the street. What is the effect of the ordinance requiring carriages, &c., to keep on the right hand side, but to abridge and limit the use of the street? If the Common Council have no authority to restrict the public in the use of the streets, what right have they to lay off side-walks for the exclusive use of foot passengers and prevent carts and carriages from coming therein?

The answer to all this is, that the convenience, comfort and safety of the public is protected and promoted by such restrictions. The greatest good

is thereby afforded to the greatest number, and to attain this, the particular inconveniences of the few must be disregarded. If public health or convenience should dictate the expediency of making a canal for boats in the centre of a public street, (as was at one time the project for Canal street,) surely the inconvenience which a portion of the inhabitants might suffer from being deprived of the power of crossing at any part of the street, and travelling over the centre of it with carriages, could not prevail against the advantages to the whole as a community from such a measure.

It all results, then, in this—If the advantages to be derived by the community from the use of a railroad in any street of the city, should preponderate over any public disadvantages with which such use might be attended, it is the duty of the common council to give their consent to such use; if otherwise, to withhold it. The matter does not involve a question of *right* on the part of the common council, but presents one for their judgment and sound discretion.

R. EMMET.

Jan. 6, 1840.

The following extracts from the 2nd report of the British commission on a general system of railways in Ireland, "on the influences of railroads in developing the resources of a country," are so true, yet so little understood by the multitude, that we give them a place in the Journal, with the hope that they may find their way into some of the daily papers of this city, and thus reach those who ought to understand the subject better than they now appear to.

ON THE INFLUENCE OF RAILWAYS IN DEVELOPING THE RESOURCES
OF A COUNTRY.

Experience testifies that increased facilities of intercourse between distant places, and more especially between sea-ports, and the interior of a country, are among the most effective means of extending civilization, with its attendant lights and benefits. Together with the opportunities of communication, a desire to take advantage of them is diffused, and this readiness will be more decided, and the important results to be expected will follow more promptly, in proportion as the means thus presented shall combine security with convenience, and despatch with both.

The proofs and instances which sustain this assertion are not confined to the case of any one country or district; although they are more observable in communities where the resources of wealth and commerce, already possessed by the inhabitants, enable them to turn every advantage, as it arises, to immediate account. In England, wherever new channels of communication have been opened—either between different parts of the interior, or the interior and the coast, or between different sea-ports one with another, or with other countries—these opportunities have invariably been embraced without delay; and the changes so produced have been, on that account, the more striking. In less favored countries, the ability to profit by the occasion does not always exist, but must be acquired by degrees; consequently, improvement also will be gradual, and its first manifestations the more tardy.

The degree to which intercourse is not merely promoted but actually

created by the facility of accomplishing it, could be scarcely credited, but for the numerous and authentic examples which establish the fact. The omnibus traffic, of modern introduction, between different parts of London and its principal suburbs, is a familiar instance which immediately suggests itself. There is a constant succession of those conveyances, to and fro, through all the leading avenues and streets of the metropolis, and their number is increasing daily: yet, in addition to these frequent means of transfer from east to west, small steamers are continually plying between Westminster bridge, Hungerford market, Dyer's wharf, and the Surrey side of London bridge; by which many thousand persons are withdrawn every day from the omnibus traffic; while below London bridge the number of passengers, by steam vessels, down the Thames—also an introduction of recent date—amounts to several millions in the year.

We learn that each of the two Greenwich steam packet companies carried, last year, about 400,000 passengers; that the Woolwich old company, calling at Greenwich, carried more than 100,000 Greenwich passengers, besides 192,000 to Woolwich; and the New Woolwich company carried nearly 100,000 passengers between Woolwich, Blackwall and London bridge. To these are to be added the many thousands who pass those places to Gravesend, Margate, Ramsgate, Southend, Dover, Herne bay, &c., &c.; and, above all, the multitudes, greatly exceeding one million, who, during the last year, passed by the railway to Greenwich, while the public conveyance on the high road scarcely appeared diminished in number or in the frequency of their journeys.*

These may possibly be regarded as peculiar cases, incidental to the immense population of the great metropolis; but similar results are found to occur, in a proportionate degree, in places quite beyond the circle of that influence.

A writer on statistics (G. R. Porter, Esq.) relates, that two generations back "there were no means of reaching London from Horsham, in Sussex, but on foot, or on horseback—the latter not practicable in all seasons.—Horsham is 36 miles from London—and the journey between the two places now occupies less than four hours. More than thirty coaches pass through it daily, to and from the metropolis, in addition to private carriages, post chaises, &c. The traffic of goods, chiefly coal and agricultural produce, carried on in the district of which Horsham is the centre, exceeds 40,000 tons in a year; besides which, the road is constantly covered with droves of cattle, and flocks of sheep."

This result has been obtained by a rise of only the first degree in the scale of improvement, namely, and excellent road, without even a canal. It is the effect of improved communications on a country of rich soil, and bears analogy to what has taken place in many parts of Ireland.

By referring to our notes, A and B, it will be seen, that on the Stackton and Darlington Line the passenger traffic, prior to the establishment of the railway, amounted only to 4,000 persons in the year; it now exceeds 16,000. On the Bolton Line the average weekly number of passengers is 2,500, whereas the number of coach journeys out and in per week, which the railway has superseded, amounted only to 28, carrying, perhaps, on a weekly average, about 280 or 300 persons.

* We believe it to be a fact, that thirty years back, the only public mode of conveyance between Woolwich and London was by coach; and two coaches, each leaving and returning twice in the day, were then deemed sufficient for the whole passenger traffic of that place. There are now omnibuses leaving twenty-four times, and returning as often, in the day; and a still greater number of vans and single horse coaches, running, as they fill, to Greenwich only whence most of the passengers proceed by railway, steam boat or omnibus, to London.

On the Newcastle and Carlisle road, prior to the railway, the whole number of persons the public coaches were licensed to carry in a week, was 343, or, both ways 686; now the average daily number of passengers by railway, for the whole length, viz., 47½ miles, is 228, or 1,596 in the week.

The number of passengers on the Dundee and Newtyle Line exceeds, at this time, 50,000 annually; the estimated number of persons who performed the same journey, previous to the opening of the railway, having been 4,000.

Previous to the opening of the railway between Liverpool and Manchester, there were about 400 passengers per day, or 146,000 a year, travelling between those places by coaches; whereas the present number, by railway alone, exceeds 500,000.

In foreign countries the results arising from the same cause are equally if not more striking. The number of persons who usually passed by the road between Brussels and Antwerp was 75,000 in the year; but since the railroad has been opened from the former place to Malines, it has increased to 500,000; and since it was carried all through to Antwerp, the number has exceeded a million. The opening of a branch from Malines to Termonde, appears to have added 200,000 to the latter number; so that the passenger traffic of that railroad, superseded a road traffic of only 75,000 persons, now amounts to 1,200,000.

It is remarkable, that on this, as on most other railroads, the greatest number of passengers are those who travel short distances, being as two to one compared with those who go the whole distance. This appears from a statement read by Mr. Loch, before the Statistical Society of Manchester, showing that between April 30th and August 15th, 1836, 122,417 persons travelled the whole distance, and 244,834 short distances; chiefly to and from Malines. He further states, that "nearly one-third of the whole revenue of the railway is derived from travelling to and from Malines, and paying a fare of about 60 centimes or nearly sixpence sterling." On the same authority we learn another fact, most deserving of attention in calculating the probable success of a railway in such a country as Ireland, viz:—that nearly three-fifths of the whole revenue of the company are derived from passengers of the lower class, paying a very low fare.

The following list of railroads in the State of New York, now in successful operation, is extracted from the Governor's Message. From this list it will be perceived that there is but one line of railroad in the State exceeding 47 miles in length, to wit—the line from Albany to Auburn, which line in truth consists of four distinct companies—making together 170 miles of continuous rail-track, and which in our view of the subject completely refutes the generally entertained opinion that "railroads ought not to be extended into, or *through* cities." It is well known to the thousands who have travelled from Albany westward to Utica, Syracuse and Auburn, that rails are laid through, or across, the principal streets in most of these populous places; and that even locomotive engines are used upon them without injury, or as far as we are informed, serious inconvenience to the citizens or country people who assemble there on business, in great numbers, at particular seasons of the year.—

The railroads consist of "a continuous line of railroad from Albany to

Auburn, 170 miles; a similar line from Lockport to Lewistown and Buffalo, 47 miles; a railroad from Rochester to Batavia, 35 miles; a railroad from Schenectady to Saratoga Springs, 21 miles; a railroad from Troy to Ballston Spa, 25 miles; a railroad from New York to Harlem, 8 miles; a railroad from Brooklyn to Hicksville, on Long Island, 27 miles; a railroad from the termination of the west branch of the Chemung canal to the Tioga railroad in Pennsylvania, 14 miles; a railroad crossing the ridge between the Susquehanna at Owego and the Cayuga lake at Ithaca, 29 miles; and a railroad from the line of Massachusetts at West Stockbridge, to the city of Hudson, 30 miles. These roads have all been constructed and are managed by companies.

NEW MODE OF PRODUCING COPIES OF MEDALS AND METALIC ORNAMENTS.

A curious, and we conceive, extremely valuable discovery has been lately made by a gentleman named Spencer, of Liverpool, by which he appears to be enabled to obtain fac-simile copies in copper, of medals and other subjects in relief, by means of voltaic electricity. We have perused a paper read before the Liverpool Polytechnic Society, in which a variety of experiments are detailed relative to this discovery, some of which appear to have been highly satisfactory; whilst others not so successful have yet developed facts which may be eminently useful in directing the adaptation of this discovery to various departments of the arts.

Without following Mr. Spencer through the several experiments which he has detailed to the Society, we may state generally certain results at which he has arrived, and the means by which he has obtained them.

It appears that from a long investigation of the phenomena of electro-chemical science, Mr. Spencer perceived that voltaic electricity afforded the means of conducting copper from a solution of sulphate of copper in the voltaic battery, and depositing it in mass in its metallic state upon other metallic surfaces, placed within the range of the electric action. To render this process useful, it is necessary to bring the operation completely under command, in order that the metal deposited may be made to arrange itself in such forms as shall be conducive to the productions of works of art.

In order to effect this, attempts were made by depositing the copper, through the voltaic agency, in raised lines or ridges upon the surfaces of metal plates, which might be capable by their relief, of being employed for surface printing (as stereotype plates.) This was partially accomplished, but the most successful attempts appear to have been the production of fac-simile copies of medals.

The means adopted in this case, were two discs of sheet lead, and having the medal placed between them, were submitted to pressure, either in a stamping or rolling press, which caused the lead to take the counter impressions of the two faces of the medal, each as a matrix. In these leaden moulds, when so prepared, copper wires from the voltaic battery were inserted, and the two faces, or hollow matrixes, being then put together, and the galvanic process carried on, the copper became deposited in a few days in the mould, and ultimately filled the mould, producing eventually a mass of deposited metal in the identical shape and exact fac-simile of the original medal.

If the moulds were separately employed, of course the two faces of the medal would be obtained separately, and might after a thin coating or shell

had been deposited in each, be backed or filled up by some easily fusible metal.

When copies are to be taken from bronze or other figures, it is proposed to take casts in plaster, and to coat the internal surfaces of these casts with leaf gold. Or metallic foils may be pressed on to the external surface of the figure, and its shape so taken,—which moulds being submitted to the voltaic process, as above stated, the copper will be deposited in the exact form of the original.

It will be perceived that we have not attempted to go into any minute details of the manner of conducting this curious operation, or of explaining its extensive adaptations; we have not yet seen any of its productions, but we hope to be enabled shortly to lay before our readers further particulars of the discovery, and of its useful appropriation to many of the purposes of art to which we conceive it will be found applicable, and form a new and valuable feature in practical science.

As it may be more satisfactory to give the author's own words as to his process, we quote a portion of his paper in which he says, "In September, 1837, I was induced to try some experiments in electro-chemistry, with a single pair of plates, consisting of a small piece of zinc and an equal sized piece of copper, connected together with a wire of the latter metal. It was intended that the action should be slow; the fluids in which the metallic electrodes were immersed, were in consequence separated by a thick disc plaster of Paris. In one of the cells was sulphate of copper in solution, in the other a weak solution of common salt. I need scarcely add, that the copper electrode was placed in the cupreous solution—I was desirous that no action should take place on the wire by which the electrodes were held, together, and to attain this object I varnished it with sealing wax varnish, but in so doing I dropped a portion of the varnish on the copper that was attached."

"The operation was conducted in a glass vessel; I had, consequently, an opportunity of occasionally examining its progress, when after a lapse of a few days, metallic crystals had covered the copper electrode;—with the exception of that portion which had been spotted with varnish, I at once saw that I had it in my power to guide the metallic deposition in any shape or form I chose, by a corresponding application of varnish or other non-metallic substance."

"I had been long aware (of what every one who uses a sustaining galvanic battery with sulphate of copper in solution must know) that the copper plates acquire a coating of copper from the action of the vallets, but I had never before thought of applying it to a useful purpose."

Then follows the details of experiments, the results of some of which we have stated above, and hope to return to this subject with further particulars of the process and its achievements, on a future occasion.—*Repertory of Arts, Sciences and Manufactures*.

"A DESCRIPTION OF THE TURNBRIDGES ON THE HEREFORDSHIRE AND GLOUCESTERSHIRE CANAL."—By Stephen Ballard, A. Inst. C. E.

In taking to pieces the old turnbridges on the Herefordshire and Gloucestershire canal, the author observed that the spikes used to fix the planks down to the carriers had caused the decay of the timber; that the balance weights of stone confined in a box under the planks kept the timber very moist; that the timbers near the ground where there was not a free circulation of air, and the wood wherever it was pierced with iron, were decayed.

In the bridges now described, no spikes are used to fix down the planks, but the planks are held in their places by two flat rods extending the whole length of the planking. The author then describes in detail, by reference to the drawing accompanying the communication, the peculiar method of construction which he has adopted. The planks are five-eighths of an inch apart, so that dirt and wet may not lodge in the joints. The bridge is balanced by two stones hung at the ends of the swing poles of about 6 cwt. each. The four principal carriers are supported by three cast-iron bearers fixed to a grooved circle, which rests on cast-iron balls, running in another grooved circle. By this construction no planks are pierced with spikes; the box of stones is got rid of, and a free access of air is obtained; and the peculiar causes of destruction to which turnbridges are exposed, are it is conceived in a great measure obviated.—*Transactions of the Institution of Civil Engineers.*

RECEIPTS ON THE HARLEM RAILROAD.—Fare for passengers for
December, 1838, \$3,819 32

do. 1839, 5,108 02

Showing an increase the last month of \$1,288 70 over the corresponding month of the previous year, equal to $33\frac{1}{3}$ per cent.

The receipts on this road for the last three years are as follows, viz:—

Fare from January 1st, to December 31st, 1837, 55,622 18

do. do. do. do. 1838, 79,794 74

do. do. do. do. 1839, 99,811 23

The increase of receipts, comparing 1838 with 1837, is \$24,172 56, or 44 per cent., and of 1839, compared with 1838, is \$20,006 49, equal to 25 per cent. increase.

This statement exhibits conclusive proof of the growing usefulness to the public, of this road.

It is in fact but the first link in the main chain of that mighty and measureless system of internal communication, which, connecting with the N. York and Albany railroad, commencing by its charter, at the termination of the Harlem railroad, and branching throughout our State, throughout New England, and to the whole interior of the Great West, will be rendering those immense inland communities tributary to this State and its metropolis.

It is even quite evident that railroads are destined to produce as great a revolution in the conveyance of passengers on the land, as steamboats have done on the water.

BUNNETT AND CORPE'S CONCENTRIC STEAM ENGINE.

Sir.—In the letter of your correspondent (Mr. Macdonald) relative to our patent Concentric Steam Engine which appeared in your last number, the conclusions he has drawn are so erroneous, that we shall feel obliged by your insertion of this in the following number.—While he admits that the result of the trials of the modes of applying the power by the tables published in your former numbers, which shows a gain of more than two to one, are correct, and might naturally have been expected, he asserts that one main feature in the case has been overlooked, viz., that the consumption of steam is equal to the power gained; this is quite at variance with the fact, as we shall endeavor to show. We have now just completed a high pressure engine on the concentric principle, the piston of which is 12 inches broad and 8 inches deep, containing 96 square inches, the crank throw is 9 inches, the stroke consequently 18 inches, the outer curve of steam chamber, an arc of a circle, 2 feet 4 inches in diame-

ter, the inner curve 1 foot diameter. Now supposing this chamber to be completely filled with steam at each stroke, allowing for the concentric form, it would contain 1872 cubic inches. A cylinder on the vertical or horizontal principle of the same area of piston would require 1728 cubic inches to fill it, (which is the extent of the difference, as any increase of the radius of curve tends to reduce it,) just one-twelfth less than the concentric engine, whose gain of power by its direct application, as shown by the tables, he does not dispute. This is supposing that all the steam it is possible to admit, is thrown into the cylinder at each stroke of the piston, but it is admitted by most engineers that all the steam thrown into the cylinder after the piston has completed two-thirds of its stroke is useless and detrimental, by the arrangement of our slide valves, we effectually cut off the steam at two-thirds of the stroke, which cannot be effected by the present locomotive engines with the single slide, therefore taking one-third from 1872, the quantity of steam we should actually use in the concentric engine at each stroke of the piston would be 1248 cubic inches, considerably more than $\frac{1}{4}$ less than the present engines, to say nothing of waste by exhausting the steam in the passages, which we entirely avoid. It is, we conceive, no fault in our concentric engine, that it does not differ in principle from the best engines of the day. We have only sought by new forms and combinations to get a more direct application and consequent increase of power; how far we have succeeded, we shall shortly be enabled to show by an engine of about 10 horse power that we are erecting on our premises at Deptford, for the purpose of testing its power, consumption of fuel, etc. Pending that trial it was not our intention of troubling you or your readers with any communication on the subject, but (adopting your correspondent's words,) we are inclined to believe that the appearance of this letter may be useful at least to us, in counteracting whatever erroneous views may have been formed by the perusal of your correspondent's communication. We remain Sir, your obedient servants,

BUNNETT & CORPE.

"OBSERVATIONS ON THE PRESENT MODE OF EXECUTING RAILWAYS, WITH SUGGESTIONS FOR A MORE ECONOMICAL, YET EQUALLY EFFICIENT SYSTEM, OF BOTH EXECUTING AND WORKING THEM."—
By Francis Wishaw, M. Inst. C. E.

The author at the commencement of this paper alludes to the principal causes of the great differences between the original estimate and cost of railways. Among these he enumerates the imperfect knowledge of the strata, which occasions the cuttings and embankments to be formed with slopes, which are dangerous, and add to their cost—the imperfect formation of the embankments, especially in clayey soils, which in the opinion of the author ought to be carried up in layers or courses of from $1\frac{1}{2}$ to 2 yards in thickness, sufficient time being allowed for subsidence before the next layer is added—the cost of stations, which in some of the great lines forms a considerable proportion of the whole cost.

The author then proceeds to suggest means for effecting a considerable saving in the original cost of railways, a certain method of preventing accidents by collision, a saving in the annual expenditure, and a better adaptation of the locomotive engine to its work.

With these views, he proposes a single line of rails—that the line should be divided with intermediate engine stations, three on the London and Birmingham for instance, the engines at each being suited to the prevailing gradient of the district. Thus a line of railway may be more easily

laid out, as one or two unfavorable inclines will not affect the working of the whole. At each station there must be a small portion of an additional line of rails, and also at other convenient intervals. The mode of working such line is as follows:—Engines are to start simultaneously in each direction from the terminal and intermediate stations. These engines will pass each other at one of the portions of the double line, and the engine being reversed and taking the other train, will return to the station from whence it started, when another exchange of trains takes place. Thus there is a regular interchange of loads throughout the day, and each engine is confined to its own portion of the line, and it is impossible that a collision can take place. Equal accommodation would be afforded to the public, and the engine-man, from being always confined to the same small portion of the line, would be perfectly conversant with every part of it. The saving which would on this system be effected on the original cost is estimated at more than 5000*l* per mile.—*Trans. Ins. C. E.*

WESTERN AND ATLANTIC RAILROAD.—The committee on internal improvement in the Georgia legislature, have reported strongly in favor of the State's completing the Western and Atlantic railroad to Ross' Landing on the Tennessee river. The cost thus far to the State, has been \$1,614,357. It is estimated that the work may be completed for \$559,705, for which the contractors are willing to receive the State bonds in payment.

The committee also recommend the adoption of a resolution granting to the Hiwassee railroad company the privilege of extending their railroad into the territory of Georgia, with the fullest permission to said company to select their own route and point of connection with the Western and Atlantic railway. If we mistake not, a resolution was adopted at the last session of the Georgia legislature pledging the faith of the State to construct a branch connecting the two roads. The distance would be only about fifteen miles.—*Nashville, (Ten.) Banner.*

RAILWAYS.

Few works on the subject of railroads have been published, which enter so much into the necessary and important detail of the construction and management of that species of public work, than the one now before us by Lieut. Peter Lecount, R. N.

The necessity has long been felt for a well digested work upon those subjects, which the merest tyro in the profession immediately recognizes as desiderata in the usual treatises upon such subjects. The present volume, though nominally a reprint of an article in the *Encyclopedia Britannica*, is much enriched by additions upon the most important topics. We shall from time to time give our readers selections from those portions of the work most novel in their character, and commence in the present number with an extract upon the subject of railroad accounts and statistics, together with the introduction of the work.

In treating of the construction and mode of working railways, we shall confine ourselves principally to those which are intended for the transit of passengers and goods, and which are now opening so vast a field for the improvement of the human race; an improvement, in fact, entering into all the relations between man and man, and which no one, be he ever so sanguine, can venture to fix a limit to.

From the middle of the seventeenth century various contrivances have been in use for decreasing friction on roads, particularly near the collieries in the north, such as laying down tracks of wood and stone for the wheels of wagons; it having been found that the much greater quantity of work performed by horses on these tracks, or, in other words, the less number of horses required to do a given portion of labor, more than repaid the expenses attendant on forming the tracks. These, in general, gave way to the flat or tram rail, made of iron; but the improvements were very slow, and at last were only applicable to certain circumscribed localities and materials for carriage.

Possessing little general interest, and chiefly benefiting individuals, the attention they attracted was principally confined to the parties immediately connected with them. But how different is the prospect now before us, since we have seen the magnificent creations of George Stephenson? Pack-horses are still the only mode of transit for traffic in many parts of the world; and within seventy years this was the general mode of conveyance for the carrying trade to Yorkshire and Lancashire from the west of England and Birmingham. In the year 1830, when the London and Birmingham railway was projected, the expense of constructing it was stated at six thousand pounds per mile with one line of rails, which were to be worked by horses, and warranted to go eight miles an hour; now the public are complaining of going *only* twenty miles an hour, and we have a right to expect, that at no very distant period, this velocity will at least be doubled; in fact, at the rate improvements have been advancing for the last few years, we know not where to place a limit of increase in speed.

It is of these splendid creations that we have here to speak. We shall show the method of conducting a modern railway, from its earliest commencement, through all its various stages in each department, both in and out of doors, up to the period of its final completion; and shall end by explaining the method of setting it in full operation, pointing out, in each division of the labor, those modes of proceeding which will most conduce to a satisfactory result, and marking those things which practice has shown should be avoided; collecting the contrivances and appliances which have been found useful, from whatever source they may be derived, and setting a beacon upon shipwrecks, that they may become other men's landmarks.

At page 336 he says.—“The last department which we shall describe is not the one of the least importance. It is that in which all the statistical details are wrought out; it deals in final quantities and prices, and in ratios. With the duties of this department, may be advantageously united the very essential branch of making and registering all experiments. The statistical details of railways are now becoming of such importance, that the government should undertake to publish them in a connected form. In the meantime, each company should, for their own sake, keep an exact register of them, to accompany their half-yearly reports. The Liverpool and Manchester company set an excellent example, in this respect, for several years and it is to be regretted they have not continued to issue these valuable documents, in order that the degree in which the expenses lessened as the road became consolidated, and the management of a new and unusual undertaking became better understood, might have been ascertained.

Nothing will tend more strongly to keep down the expenditure of railways than the free publication of these statistics; bad management must then become apparent, and the evil, once known, cannot fail to be remedied. It will be like the publication of the duty done by the steam engines in the Cornish mines; every one will be continually stimulated to keep pace with those companies who show themselves to be the most efficient in their busi-

ness; and the relative value of the respective managers will become apparent. At present we have no statistics for long lines. This state of ignorance, it is hoped, will not continue.

Numberless experiments are yet required to determine the laws which should govern railway practice; and by far the greatest portion of these could be conducted with but little, if any expense, beyond that of a mere registration of passing facts; the value of others, again, would amply repay the outlay which would be necessary in order to make them. Railways have now been in operation eight years, yet we have no generally recognised constant quantities applicable to their daily practice; friction, cohesion, power, consumption of fuel and water, wear and tear, expense of principal and secondary stations, cost of management, and many other equally important items, are all variously stated and in part assumed; so that new undertakings are, to a great extent, laboring in the dark for want of receiving that assistance which would be in all cases beneficial to both givers and receivers.

This department should be in operation from the first commencement of the railway, and during its progress should be employed in keeping an exact account of the state of the respective works; the quantity and price of all materials used in the construction of the railway; comparing these with the estimates; comparing the work done with the time in which it ought to have been done; keeping detailed accounts of each of the articles composing the permanent way; testing all the rails as they are received, examining the merits of new inventions and improvements, and all other matters of a similar nature; but when the railway is opened, the most arduous duties will commence, and we are satisfied railway statistics will never be placed on a proper footing, till government undertakes the business, and issues out printed forms to be filled up by each company.

The statistical department should be a confidential one, and no person except the principal should be able to arrive at final results. These should embrace every branch of expenditure, and should be made out and registered every month, and printed every six months; being reduced, whenever it is possible, to the rate per passenger per mile, and per ton per mile respectively, for passengers and goods; with the reasons for any increase or decrease. This periodical statement would be a powerful incentive to economy, and at all times it would be seen, whether or not the money expended preserved its proper ratio with the work done.

The statements which should be shown by this department, would fall into two principal heads; first, the expenditure and receipts, under the head of passengers and goods, in all their details; and next, a classification of these details; those cases where the expenditure is of a general nature, being dealt with accordingly. For instance, the maintenance of the permanent way should be apportioned between the coaching and carrying departments, in the ratio of the weights carried by each of those departments and the relative velocities. The police, switchmen, gate keepers, general office establishment, rents taxes, interests on loans, &c., should be apportioned according to the ratio of profit in each department, this ratio being taken exclusive of those items.

The details should show the expenditure in the coaching and carrying office establishments, guardes' wages, porters' wages, brakemens' wages; expense of cartage, distinguishing horse keep; wages repairs, &c.; duty on passengers, gas, water, oil, grease, tarpaulins, ropes, slings, &c.; for, in each case, the coaching and carrying departments separately. The general office disbursements, including direction, advertising, printing, law salaries, &c.; all given separately. The maintenance of way, including en-

gineers' and clerks' salaries, mens' wages, cost of ballast, carriage of ditto, cost of repairs to permanent way, as well as that of relaying, the cost of new articles, &c. The locomotive expenditure should be shown in coke, carriage, water, gas, wages to engine-men, firemen, laborers, and mechanics, oil, grease, waste, tools, wood, iron, brass, copper, and the nature of the repairs; which should also be shown in the coach and carrying repairs.

The number of miles travelled by the engines in each department; the number of tons of goods, gross and nett, carried one mile, classed according to the rates of carriage; the number of passengers carried one mile, the classes being distinguished; the weight of every train, the expenditure of fixed engines in detail, the cost of inclined planes, their gradients, velocity of the descent with definite weights and carriages, the flexure of rails and resistance to rolling, comparing the method by pendulum wheels with others; and, generally, every item of expenditure, under whatever class it may arise, which can lead to a comparison with that of other railways similarly circumstanced.

Having thus given every detail respecting the cost of working the line, the next step should be to classify them, so as to give the outlay per passenger and per ton per mile, under the several heads of coaching and carrying departments; the proper proportion of all the other items being placed against the coaching, or the carrying, as the case may be. It will then be desirable to give, per passenger, and per ton per mile, respectively, the cost of portage, police, coach repairs, wagon repairs, office expenses, locomotive power, and maintenance of way; coke, repairs, wages and water, as respects the engines, being given separately, as well as collectively: and the wages, ballast, carriage, materials and tools, in the maintenance of the way, distinguished in like manner, the whole being reduced to a series of tabulated forms, so as to present at one view, all the statistical facts connected with every operation on the whole railway.

If we look back at the rapid progress which we have made in the science of locomotion during the last half-dozen years, and at the degree of comfort and accommodation, which, in conjunction with rapidity of transport, have been afforded to the public, at, in most cases, so very moderate a cost, the strides by which we have attained our present advanced position, are certainly sufficiently gigantic; but if we look forward, it requires but little of the gift of divination to perceive, that in a very few years more, a still greater change will take place, more particularly in the essential article of comfort. In a mode of transit so essentially new, and in which all our previous machines and appliances had to be completely reorganized, and numerous inventions of almost every kind were to be produced at a moment's call, to meet the various difficulties and wants which were continually arising out of such a novel mode of conducting the business of travelling in what may be called the wholesale way, it has been singularly fortunate, that in almost every instance, the various railway companies have kept on the safe side, that is to say, they have not done too much. They have erred on the best side they could commit an error on; they have been too cautious. It seems as if it required a certain time merely to travel at twenty miles an hour, and let the mind sober down a little before much else could be attempted. This feeling may now be rapidly expected to give way, and we shall find that as confidence is acquired, all the requisite arrangements will become consolidated in much more perfect and improved forms.

There is nothing now which ought to be more attended to by railway companies, than keeping their fares down; and this has in most instances been very much neglected. When parties possess such a complete monopoly as a railway, they should be particularly careful not to show it.—

The expenses in many instances are certainly very great, and the companies have much to suffer in their progress through Parliament, and the rough grinding they have generally received from the rapaciousness of landowners. Accidents, too, must happen, estimates will be exceeded, and these sources of expenditure must be met by a corresponding rate of price; but when the railways are made, the feeling seems to be too general among some of these proprietors, that this is the moment for making reprisals upon the public for all losses, vexations, mishaps and mistakes.

In some cases railways have charged more for the carriage of passengers than the stages or mails did, trusting to beat them on the question of time only. In fact the receipts are great; a certain sum must be set aside for a good dividend, and the rest is to be spent somehow or other. The same thing is observable in the statistics of the road trusts, many of them largely in debt, yet spending their money on fancied improvements, instead of getting out of debt, and then lowering the tolls.

The effect of this on travelling is fully shown in the report of the Irish Railway Commission. For instance, the travellers from Brussels to Antwerp by railway in the year 1836 were 872,893, whereas those on the Liverpool and Manchester railway for the same year were only 522,991, being the largest number for any year since the opening. Now, the population of Brussels, Antwerp and Mechlin was 209,200, while that of Liverpool, Manchester and Warrington was 586,812, considerably more than double, or the ratio of population was as 2:327 to 1, while that of the travelling was only as 599 to 1. We must seek for the solution of this problem in the respective fares of the two companies. In the Liverpool and Manchester railway, Mr. Pambour states, that there are 13 first-class trains to 16 second class: and as the last class hold most passengers, suppose we omit the mails, and say $\frac{13 \times 5.5s. + 16 \times 4s.}{29} = \frac{135.5}{29} = 4.6724$ shillings, the

average fare. We have no means of ascertaining the numbers on the Brussels railway, but if we take the dearest and cheapest, and compare them in the same ratio as we did the others, we shall have $\frac{3.50 \times 13 + 1.20 \times 16}{29} =$

$\frac{64.70}{29} = 2$ francs 23 cents per passenger on the average, or about 1.784 shil-

lings, or 4s. 8d. in the one case, and 1s. 9½d. in the other, or, allowing for the value of money in the two countries, about double the price; and this double price is accompanied with only one-fourth of the travelling, the ratio of population to that of travelling being very nearly 4 to 1. A still stronger case is that of the Paisley canal, where the fly-boat fare is 1d. per mile. Here, with a population of 262,725, the passengers in 1835 were 373,290, while in the same year, with a population of 486,812, the Liverpool and Manchester railway had only 473,849 passengers. The railway company from Paris to St. Germain's has tried the experiment of low prices with complete success; their greatest reduction of fares was at the station of Nanterre, where they were lowered from 7½d. to 5d. and the result was, that 12 days, ending the 4th December, 1838, at the low fares, compared with 12 days ending November 22, at the high ones, showed an increase of 839 passengers; and although the diminution in price was 34 per cent., the increase in the amount received was 16½ per cent. We therefore strongly recommend that fares should be moderate, or it will form the best plea in the world for the establishment of competing lines; and it should be remembered that railways will to a certain extent drive vans and wagons off the road, which were the ordinary vehicles for the travelling poor,

and they ought to have a substitute if it were merely an open box without seats. Soldiers are generally conveyed at 1d. each per mile, and their baggage at 3d. per ton per mile; this is less than half what is charged on some railways in second-class carriages.

The annexed extract shows the difference in the cost of railroads in England and in this Country.

Lieut. Lecount says, that "Railways with two lines of rails in very favorable situations have been completed for 10,000*l.* per mile in England. This, however, must be taken as the exception, and not as the rule. Under very unfavorable circumstances they have cost 50,000*l.* per mile; and of course there will be found an expense per mile at all differences between these two, which may fairly be taken as the extreme limits. Now it is certain, that with a line 80 miles in length, a traffic of 75 tons of goods per day each way, or with 35 tons of goods and 60 passengers per day each way, the railway, if even constructed for 12,000*l.* per mile, which will rarely happen, would not afford a dividend of more than a quarter per cent., and (our numbers throughout meaning daily each way) it would require 100 tons of goods, or 160 passengers, or 50 tons of goods and 80 passengers, to pay 1 per cent.; 125 tons of goods, or 200 passengers, or 62 tons of goods and 100 passengers, would but little exceed 1½ per cent.; and it would take 200 tons of goods, or 320 passengers, or 100 tons of goods with 160 passengers, to pay 4¼ per cent.

The Americans have such facilities for these constructions, that 1600 miles of railroad have been made in that country, (a good deal of it, however, being only single line,) at an average cost of only 5081*l.* per mile; whereas in England the mere permanent way alone would amount to 4400*l.* per mile, if the rails were 45 lbs. to the yard, and laid upon longitudinal timbers; 4900*l.* per mile, with rails 42 lbs. per yard, having chairs and cast iron supports between them, on longitudinal timbers;—5300*l.* per mile, with rails 42 lbs. per yard, on blocks 3 feet apart; 4,800*l.* per mile, with the same sized rails on wooden sleepers; 5600*l.* per mile for 62 lb. rails, on blocks 4 feet apart, and 5100*l.* for the same rails on wooden sleepers; 6000*l.* per mile for rails of 75 lb. per yard on blocks 5 feet apart, and 5500*l.* per mile for the same on sleepers. These prices do not include laying the way, ballasting and draining. Thus we see that the mere cost of the permanent way in this country, averaging 5200*l.* per mile, exceeds that of the whole expense of a complete railway in America; and 75 lb. rails on blocks and sleepers, including laying, ballasting, sidings turnplates and every expense, has exceeded 8000*l.* per mile.

(To be continued.)

THE HONORABLE EAST INDIA COMPANY'S STEAM SHIP, THE "QUEEN."

The fine vessel, which is of the same class as the government steamers, *Medea Phoenix*, *Salamander*, and *Rhadamanthus*, was built at Limehouse by Messrs. Curling and Young, the celebrated builders of the British Queen and President, and fitted with a pair of engines of 110 horse power each, by Messrs. Seaward & Co., of the Canal Iron Works. She is furnished with Hall's patent condensers, with apparatus for supplying the boilers with distilled water to make good the waste. The slides are of Messrs. Seaward's patent. The armament consists of four 32 pounders, besides two long guns of 8 inch calibre, one forward and the other aft, intended to carry hollow shot; they move upon slides and fixed pivots, which enables them to take a much wider range than the ordinary carriage can give.

The following are the principal dimensions of her hull and machinery :

Length between the perpendiculars,	173 feet.
Breadth within the paddle boxes,	31 "
Breadth over all,	40 "
Depth of hold,	19 ft. 6 in.
Builder's Tonnage,	766 $\frac{3}{4}$ tons.
Weight of the hull	511 "
Diameter of the cylinders.	56 inches.
Stroke of the pistons,	5 feet.
Diameter of the air pump,	28 inches.
Length of stroke,	2 ft. 6 in.
Area of the steam passages into the cylinders,	60 square inches.
Area of the education passages,	95 "
Number of tubes, 6 ft. long and $\frac{1}{2}$ inch diameter in the two condensers,	2500 "
Diameter of paddle wheels,	22 feet.
Length of the floats,	8 "
Depth of the outer board,	10 inches.
Depth of the inner,	12 "
Advance of the outer board before the inner one,	8 "
Number of pairs of floats on each wheel,	20 "
Number of boilers,	2
Number of furnaces,	6
Length of boilers,	14 feet.
Breadth of the two boilers,	21 ft. 6 inches.
Weight of the engines,	220 tons.
Weight of the boilers,	42 "
Weight of the water they contain when filled,	30 "
Weight of the coal carried,	240 "
Which at 16 tons per diem is sufficient for	15 days.

On Thursday the 24th ult. the "Queen," with a party of naval and scientific gentlemen on board, made an experimental trip from Blackwall down the river as far as Greenhithe. When she was got under way, we perceived that the *Archimedes*, which was lying a little farther down the river, had her steam up, and was ready for a run. Accordingly, as soon as we were nearly on her quarter, she started, and the two vessels maintained nearly the same relative positions for some time, until we stopped to take a party on board, when the *Archimedes* shot a-head, and as she drew about 5 feet less water than the *Queen*, she was enabled to keep nearer in shore, so as not to feel the full influence of the tide. Notwithstanding this advantage the *Archimedes* did not seem to gain upon us, by which we judge her speed *through the water* to have been rather less, or at least not more than ours. The *Archimedes* returned without having proceeded so far as Erith, or having ascertained her rate through the water; but, by comparison with the speed of the *Queen*, as found at the measured mile in Long reach, we should suppose it to have been about $9\frac{1}{2}$ statute miles an hour. As she passed us on her return she fired a salute of two guns, we suppose in token of victory. We then proceeded to Long reach, where we noticed the time of running a mile, first against both wind and tide, then with both in favor. The results were as follows:

Time of running the mile against the tide 9'3"

Time of running the mile with the tide 4'44"

whence we deduce the speed of the vessel over the ground.

Against the tide, 6.32 miles

With the tide, 12.68 "

Mean speed, independent of the tide, 9.5 "

The number of revolutions of the wheels per minute, with wind and tide

in favor, was $19\frac{1}{2}$ —against wind and tide, $18\frac{1}{2}$, which shows that the difference of speed *through the water* must have been *more than half a mile* an hour.

The mean draught of water was about 14 feet 6 inches, and the dip of the floats 3 feet 9 inches; but, as the ship had "a list to starboard," the dip of the larboard wheel was a little less, and that of the starboard wheel a little more than the above; which accounts for the fact, that the back-water from the latter was rather considerable, while there was nothing but a slight full of spray from the former, through which the wheel was distinctly seen.

The pressure in the boiler before the experiment, was 5 lbs. on the square inch, but just before we arrived at the measured mile, it had fallen to $4\frac{1}{2}$ lbs. The gauge on the starboard condenser marked $29\frac{3}{4}$ inches of mercury, and that on the larboard condenser $29\frac{1}{4}$; the oscillations were seldom greater than $\frac{1}{4}$ of an inch, sometimes even less. The motion of the engines was during the whole trip remarkably smooth and regular.

Having finished the above experiments, we were summoned to an elegant and substantial cold collation, which had been prepared by our hospitable entertainers, the Messrs. Seaward, and the day passed very agreeably, in spite of the weather, which was by no means such as to enhance the pleasure of an excursion by water.

ON STEAM BOILERS AND STEAM ENGINES.—By Josiah Parkes, M. Inst C. E.

In a preceding communication the author had treated of the amount of evaporation in different kinds of boilers in common use: in the present, he treats of their peculiar and relative merits as evaporative vessels; the laws which regulate the amount of evaporation for assigned heated surfaces; and the practical rules whereby the performance of boilers may be tested. The water evaporated and fuel consumed, had been tabulated in the previous communication; the author now gives the dimensions of the several boilers—the area of the grates—the area of heat-absorbing surfaces, and the rates of combustion and evaporation. The connexion of the boiler with the engine as regards the proportion of boiler to engine power, is reserved for consideration in a subsequent communication; the attention is now confined to the influence of the proportions of the parts on the performance of boilers for a given weight of coal. Evaporation may be considered as the measure of the useful effect obtained from any weight of fuel, or, together with the duty done by an engine, the measure of the useful effect of a given weight of water in the shape of steam. The author insists on the importance of ascertaining with accuracy the weight of the water, which in the shape of steam has passed through the cylinder of an engine. The weight of water, or quantity of steam, requisite for producing a given effect or duty, was the subject of continual research by Smeaton; and the basis of Watt's discoveries.

The author being led to make observations on evaporation twenty years ago, soon perceived that the completeness and rate of combustion, the proportion of the grates to the combustion effected upon them and to the whole heat-absorbing surface, were important elements in evaporative economy. These elements, in the author's own experiments at Warwick, where slow combustion was pushed to nearly its furthest limit—in those of Smeaton at Long Benton—of Rennie and Watt at the Albion Mills—of M. de Pambour on the locomotive engine, in which intensity of combustion and evaporative power are at their highest limits—of Nicholas Wood on the Killingworth engine—and of Mr. Henwood, and others, on the Cornish boil-

er—are the data for the analysis of the evaporative effects; the true causes of which in the several experiments, the author now attempts to develop. The authentic facts here recorded of the working of boilers and engines of established credit and notoriety, will enable the employer of any boiler or engine to compare his practice with specimens of acknowledged and well-attested merit.

The results derived from the above data are arranged in a tabular form, so as to exhibit at once the relation which any one property and the several parts of the boiler bear to any other, and to the effects produced, the amount and activity of the combustion (to which the author assigns the term *calorific forces*), and the modifications it experiences by the structure and disposition of the several parts.

There are also certain quantities and relations which exert a peculiar influence over the results, which, being rightly ascertained, are exponential or indicative of the practice of each particular boiler; these Mr. Parkes calls the *exponents* of that boiler, and are as follows:—

The quantity of coal burnt under a boiler in a given time,—the quantity burnt on each square foot of grate per hour,—the quantity of water evaporated per square foot of heated surface—and the number of pounds of water evaporated by a given quantity of coal. Besides this, the influence of *time*, that is, the time of duration of any given portion of heat about a boiler, and about equal areas of surface, demands our most attentive consideration, and is especially treated of at the close of the paper. It appears most distinctly, that the boilers tested as to their merit by their respective evaporative economy, arrange themselves in the inverse order of the rate of combustion—the Cornish boiler being greatly superior to all the others when tested in this manner, as well as also as in respect of time is selected as the standard of comparison, whereby to mark the scale of descent from the highest point of excellence yet attained in evaporative economy. For this purpose, then, the Cornish results are considered as unity.

The value of the exponents for the Cornish, Wagon and Locomotive boiler respectively, are collected together in the following table, which will serve to show at one glance the respective values of the boilers on this comparison.

Boiler.	lbs.	
Cornish	1.0.	of Coal burnt under one boiler in 44.08. seconds.
Wagon	1.0.	of ditto ditto in 16.57. ditto.
Locomotive	1.0.	of Coke ditto in 6.45. ditto.
Cornish	3.4.	of Coal burnt on each square foot of grate per hour.
Wagon	10.7.	ditto ditto
Locomotive	79.3.	of Coke ditto
Cornish	1.0.	of Water evaporated by 1 square foot of heated surface per hour from 212°.
Wagon	7.1.	ditto ditto
Locomotive	12.0.	ditto ditto
Cornish	11.8.	of Water evaporated by 1 lb. of coal from 212°.
Wagon	8.8.	ditto ditto
Locomotive	7.2.	ditto 1 lb. of Coke, ditto
Locomotive	5.4.	ditto 1 lb. of Coal, ditto

The Cornish boiler possesses some peculiar advantages, both as regards structure and the practice of slow combustion, since, by the former, great strength is attained, and, by the latter, time is given for the complete combination of air with the heated fuel, for the transmission of heat through the metal, and for the escape of the steam through the water. The plates of the Cornish boiler are usually $\frac{1}{2}$ an inch thick, whereas those of a low pressure boiler are usually one fourth to five sixteenths of an inch thick; thus a much larger extent of surface is necessary to transmit a given quantity of heat in a given time in the former than in the latter case. The Cornish engineers allow seven times as much surface as in the general wagon boiler practice, for the evaporation of equal weights of water in equal times, and twelve times as much as in the locomotive; from which there is a gain of from 30 to 40 per cent. in the former, and of 64 with coke and 100 with coal in the latter case.

The wagon boiler has great disadvantages of structure, being ill adapted to resist internal pressure, liable to collapse, and greatly affected by incrustation. According to the above table, which exhibits the mean of eight experiments, the combustion is $2\frac{1}{2}$ times more rapid per boiler, and 3 times more rapid per square foot of grate per hour, and the rate of evaporation is 7 times greater than in the Cornish. The loss of heat, the Cornish being unity, is $24\frac{1}{2}$ per cent.

The construction of the locomotive boiler is so very different from that of every other species of evaporative vessel, that no strict analogy can be drawn betwixt it and any other. From the above practical results it appears, that the rate of combustion per boiler is nearly 7 times, and per square foot of grate per hour 23 times more rapid—that the rate of evaporation from equal surfaces 12 times more rapid than the Cornish boiler—the loss of heat, the Cornish being unity, 51 per cent.

The author discusses at length the varying circumstances connected with different boilers, and the corresponding influence on the above results, and particularly the system of management by which he was enabled with a wagon boiler to approach the Cornish results. The table accompanying this paper will frequently enable the intelligent employer of a boiler to ascertain the best proportion of parts, and the best practice. For, having decided on the quantity of steam he requires, he knows the quantity of fuel which will generate it if he adopts the measures of surface and proportions of parts, which have given relative effects; or he can ascertain whether his present practice be good or defective. Notwithstanding the great stride which has been made in the economy of fuel by the Cornish engineers, the sources of waste are still great, and we may hope for great advances in evaporative economy, when combustion as a science and practical art has received the attention which it merits.—*Trans. Ins. C. E.*

THE ARCHIMEDES STEAM VESSEL.

Our readers will probably recollect that the *Archimedes*, a remarkably fine formed vessel of 230 (?) tons burden, fitted with a pair of engines, of 45 horse power each, manufactured by Messrs. Rennie, and the screw propeller, as applied by Mr. Smith, was first tried early last summer, and that the experiments were suspended, in consequence of the unfortunate bursting of one of the boilers. At that time the screw consisted of one whole turn of a single thread, 7 feet in diameter, and 8 feet pitch. The boilers have now been replaced by two new ones, manufactured by Messrs. Miller and

Ravenhill; and at the same time a modification has been introduced in the form of the propeller. It consists now of two half turns of a thread, 5 feet 9 inches in diameter, and 10 feet pitch, placed diametrically opposite to each other on the propeller shaft, so as to occupy a space of only 5 feet in the length of the vessel.

These alterations being completed, an experimental trip was made down the river to Gravesend, on Monday, the 4th ult., and the result was considered highly satisfactory. We regret that we were unable to be present, as we can, therefore, only speak from information we have collected since.

We understand that she run from Gravesend to Londona bridge, a distance of 28 to 30 miles, which was accomplished in two hours, both wind and tide being favorable. No conclusion can, however, be drawn from this result, respecting the comparative performance, on account of the co-operation of the wind and tide; but the mean speed of the vessel through the water was ascertained during the trip, by noting the time in which she ran a mile, first with, and afterwards against the tide.

The results of the experiment were the following:—

Time of running the mile with the tide,	4'32"
Number of revolutions of the engine shaft <i>per minute</i> ,	22
The speed over the ground was, therefore, <i>per hour</i> ,	13.2 miles.
Time of running the mile against the tide	9'5"
Number of revolutions of the engine shaft,	23
Speed over the ground	6.6 miles.
The mean speed through the water was thus	9.9 "

The mean number of revolutions of the engine shaft was $22\frac{1}{2}$ per minute which, multiplied by $5\frac{1}{4}$ (which Mr. Smith informs us is the multiplying power of the wheel work, which communicates the motion from the engine shaft to the propeller), gives 120 for the number of revolutions of the screw per minute. If the screw were moving through a solid body, it would advance the length of its pitch in each revolution, or 1200 feet per minute, which is the same as 13.6 miles an hour; but since the vessel, and consequently also the screw only advanced at the rate of 9.9 miles an hour, there must have been a recession of the screw through the water, in the direction of the shaft, equal to 3.7 miles an hour. The proportion of the available power of the engines effectively employed in propelling the vessel was, therefore, 72.7 per cent., the remaining 27.3 per cent. being expended in obtaining the necessary resistance to the propeller.

Mr. Hearapath, in his report in the Railway Magazine for the 19th October, has committed an error of 1.1 mile an hour to the disadvantage of the performance, in consequence of taking the mean time of running a mile, and finding the corresponding speed, instead of taking the mean of the speeds with and against the tide. We believe the latter to be the method usually followed; but, in case there may be any doubt as to its correctness, it is easily demonstrated thus.

The speed with the tide is equal to the velocity of the vessel through the water (which is required to be determined,) added to the velocity of the tide which is an indeterminate quantity. Also the speed against the tide is equal to the velocity through the water, diminished by the velocity of the tide. If, therefore, we call the former V and the latter v , we shall have

$$\begin{aligned}\text{Speed with the tide} &= V + v \\ \text{Speed against the tide} &= V - v.\end{aligned}$$

By adding these two quantities together, v is eliminated, and we find that the speed with the tide, added to the speed against the tide, is equal to twice the speed through the water.—*Trans. Inst. C. E.*